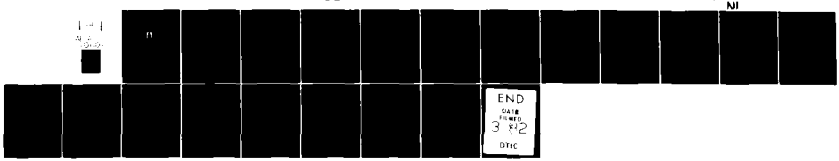
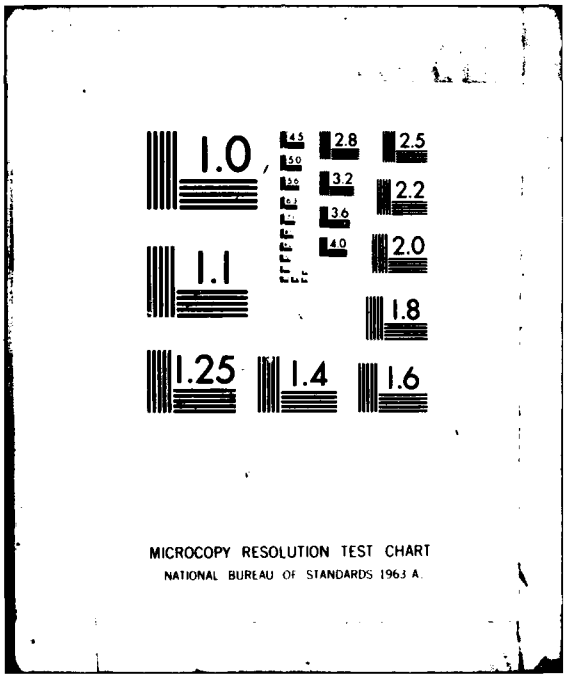
AD-A110 601 FOREIGN TECHNOLOGY DIV WRIGHT-PATTERSON AFB OH F/G 4/2
THE CLIMATE IN THE REGION OF DJERDAP (THE IRON GATE),(U)
JAN 82 K MILOSAVLJEVIC
UNCLASSIFIED FTD-ID(RS)T-1622-81 NL




1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
4.5
5.0
5.6
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963 A.

FTD-ID(RS)T-1622-81

FOREIGN TECHNOLOGY DIVISION

THE CLIMATE IN THE REGION OF DJERDAP (THE IRON GATE)

by

Katarina Milosavljevic

141600

EDITED TRANSLATION

FTD-ID(RS)T-1622-81 21 January 1982

MICROFICHE NR: FTD-82-C-000070

THE CLIMATE IN THE REGION OF DJERDAP (THE IRON GATE)

By: Katarina Milosavljevic

English pages: 18

Source: Wetter und Leben Zeitschrift fuer Angewandte Meteorologie, Vol. 23, 1971, pp. 52-61

Country of origin: East Germany
Translated by: Gale M. Weisenbarger
Requester: USAF/ETAC/MAC

A

PREPARED BY:

TRANSLATION DIVISION
FOREIGN TECHNOLOGY DIVISION
WP-AFB, OHIO.

1622,gw

THE CLIMATE IN THE REGION OF DJERDAP (THE IRON GATE)

Katarina Milosavljevic, Belgrade

With three illustrations.

Summary. In order to obtain the climatological characteristics for the region around the Iron Gate (Djerdap), where a barrage is to be built, data was processed from the meteorological stations on the right bank of the Danube in East Serbia in Yugoslavia. The air temperature distribution in this region shows much "harsher conditions" in the eastern part than in the western part. In this region an annual precipitation from 657 to 913 mm was measured The abundance of sunshine (over 2000 hours per year) is very signi.. for the tourism of this region. The mean annual wind speed is 2.6 m/s, but storms are also frequent, from a low of 68 days per year to a high of 156 days per year.

The area of Djerdap (Iron Gate) and the dammed up area of the Danube which will affect the hydroenergy system of Djerdap lie at about 44.5° N and 21 to 22.5° E in a region of moderate continental climate. Much has already been written about the climate in East Serbia and particularly about the air currents in this part of Yugoslavia [1, 2, 3, 4]. In connection with the plans for a power plant meteorological observations and evaluations have been particularly intensified. This report represents an excerpt from a detailed work.

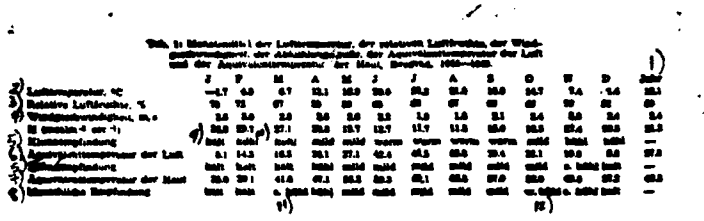
Not only the very well-known Danube crevasse "Iron Gate," but also the entire area, with its beautiful scenery, is very attractive in the tourist sense. The Southern Carpathians, the so-called Transylvanian Alps, extend over the Danube in the area of the Djerdap gorge (Iron Gate) toward East Serbia and join with the Balkans [5]. The Danube gorge actually begins at Golubac (see map, Ill. 1). The mountain area is clearly divided and permits air passages from both the north and northwest in the case of cold air intrusions from the Pannonian plane and also out of the east from the Walachian plane.

The Iron Gate which is well-known for eddies and rapids, after completion of the dam, will be turned into calm lake. At high water

the backwater will extend to the mouth of the Nera River. A number of settlements will be flooded. Undoubtedly the large backwater will affect the climate, especially of its shore area.

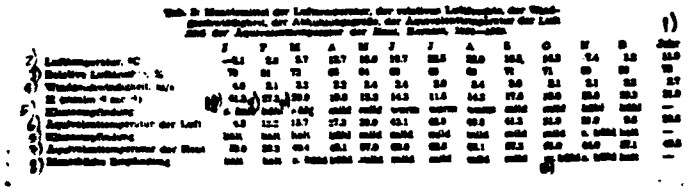
For the present treatment we used observations of the climatological stations on the right shore of the Danube from Veliko Gradiste, Tekija, Karatas, and Brza Palanka, as well as data on precipitation from 18 measuring points likewise on the right shore between Ram and Prahovo. The period of intensive investigations from January 1966 to June 1969 was used as the primary measuring period. In addition the stations in Beograd above- and in Negotin below the Djerdap storage pond area served for longer observation periods.

Table 1. Monthly mean of the air temperature, the relative humidity, windspeed, cooling value, equivalent air temperature, and the equivalent skin temperature, Belgrade, 1966-1969.



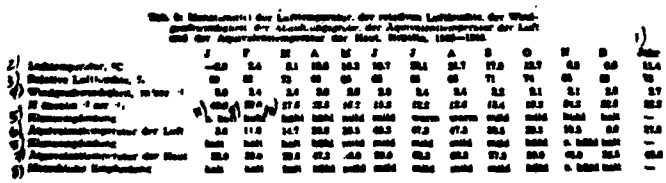
KEY: 1. year; 2. air temperature, °C; 3. relative humidity, °/₀; 4. wind speed, m/s; 5. climate perception; 6. equivalent air temperature; 7. equivalent skin temperature; 8. human perception; 9.. cold; 10. cool; 11. very; 12. rather.

Table 2. Monthly mean of the air temperature, the relative humidity, windspeed, cooling value, equivalent air temperature, and the equivalent skin temperature, Karatas, 1966-1969.



KEY: see Table 1.

Table 3. Monthly mean of the air temperature, the relative humidity, windspeed, cooling value, equivalent air temperature, and the equivalent skin temperature, Negotin, 1966-1969.



KEY: see Table 1.

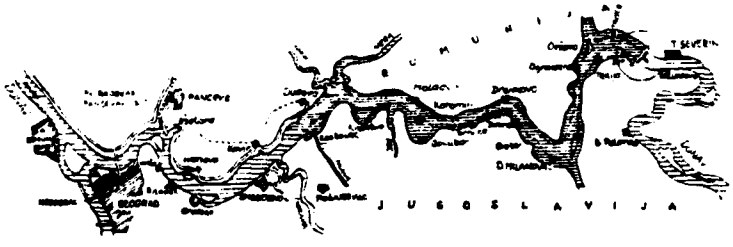


Fig. 1. The Danube region with Djerdap (Iron Gate) and the storage lake (East Serbia, Yugoslavia).

Climate Tables.

Tables 1-3 show the mean values of meteorological and bioclimatic values over several years. As far as the air temperature is concerned, Karatas and Negotin have higher values than Belgrade only in the months of July to September, and then only by an average of 0.7°C. In all other months the temperatures in the region of Djerdap are sooner cooler than Belgradeand this is particularly true for winter. In February the difference is 2.3° and the humidity in the more eastern stations is almost 10°/₀ higher than in Belgrade. By May this excess humidity decreases by about half and the remainder of the year it is still present but only about 2°/₀. The still unequalized wind averages in January, March and from June to September show somewhat higher values in the more eastern locations than in Belgrade, and in the other months they are somewhat lower.

The annual air temperature fluctuation increases from 23.0° (Belgrade in the west to 24.9° (Negotin) in the east. The number of frost days (not published here) also increases from west to east. Analysis of the extreme temperature values shows that in the summer the maxima reach equally high values but that in winter the minima, under the effect of cold air intrusions from the Walachian Plane, are significantly lower in the eastern parts. Using the monthly mean temperature and humidity, climate graphs were drawn (not reproduced here) which coincide in their overall character but which have local peculiarities and which also show the effect of the water on the

local climate. In winter this effect is slight since the Danube freezes.

The annual distribution of precipitation in East Serbia, especially in the Djerdap region, has often been described [1, 2, 3]. According to Vujevic the annual course corresponds to the central European type with abundant rain in the spring and summer. In the eastern part of the observed region, however, there is a November maximum and the summer maximum becomes secondary and shifts to June. The annual highs of precipitation in the Djerdap region, based upon the data for 24 stations, are between 657 and 913 mm, whereby the lower values are for locations near the Danube, and the higher for mountain locations. The number of days with precipitation, rain, snow and snow cover can also be found in the original work.

On the other hand Tables 1 to 3 show three different combined elements which are familiar from bioclimatology and add the evaluations according to the appropriate perception scales. One first finds Hill's cooling magnitude H and also the evaluation of the climate according to Krueger's scale [7], the equivalent air temperature, and the perception scale according to Schmid [10] and finally the equivalent temperature of the skin and the attendant climate evaluation according to Leistner and Robitzsch [11].

Duration of Sunshine and Global Radiation.

On an average over many years in Belgrade there are 2154 hours of sunshine and in Negotin 2096 hours of sunshine per year. The annual maximum was 2437 hours and the annual minimum, 1829 hours. In the time span from 1966 to 1969 the annual average was around 2100 hours (Belgrade 2085, Karatas 2163, Negotin 2069 hours).

In any case the abundance of sunshine is noteworthy and exceeds 2000 hours which is the minimum sum often indicated in climatology for an area to be designated as sunny.

But a study of the annual progress of the duration of sunshine, the number of days without sunshine and the number of days with at least 8 hours of sunshine shows relatively unfavorable conditions from November to February. Then there is a sharp rise from March to July and then a gradual and finally fast drop of the sunshine hours and a rise of the number of sun-free days in the fall.

In April and October every other day there are at least eight hours of sunshine and from May to September there are even more such days and there is seldom a day which remains fully without sunshine.

Global and diffuse celestial radiation data is present from

Belgrade for the time span from 1958 to 1968. For the present investigation we looked at the correlation of the daily sums of global radiation and the daily temperature which is a primary consideration for tourist purposes (here the air temperature at 1400). The collective values were divided into terzils month-by-month as was done by G. Hentschel [6]; the middle terzil for temperature was cold, for global radiation - dark; the upper terzil for temperature was warm, for global radiation - bright. Nine combinations of the classes are then possible. The values for Belgrade once again limited to 1966-1969, can be found in Table 4, the values for Negotin, in Table 5.

Table 4. The relative frequencies according to classes of the values of air temperature (t) at 1400 and the daily sum of global solar radiation (g) in °/₀, Belgrade, 1966-1969 (VIII).

1 / 2	Kalt Hell	Normal Hell	Warm Hell	Kalt Normal	Normal Normal	Warm Normal	Kalt Dunkel	Normal Dunkel	Warm Dunkel
Nr.	1	2	3	4	5	6	7	8	9
J	5	7	5	8	17	11	15	22	10
F	7	18	19	4	21	5	13	11	2
M	2	17	11	11	12	11	24	12	.
A	8	20	22	10	12	6	13	7	2
M	1	14	22	22	7	15	6	11	2
J	1	22	29	4	27	4	10	3	.
J	1	30	30	9	15	5	9	1	.
A	2	28	27	4	21	1	16	1	.
S	1	22	27	4	25	5	9	5	2
O	3	15	39	.	19	13	5	4	2
N	2	6	10	7	12	18	27	12	6
D	3	10	6	10	15	2	15	28	11
4) Jahr	36	209	247	93	203	96	162	117	37
5) Fr	11	51	55	43	31	32	43	30	4
6) So	4	80	86	17	63	10	35	5	0
7) He	6	43	76	11	56	36	41	21	10
8) Wi	15	35	30	22	53	18	43	61	23
Fr - So	15	131	141	60	94	42	78	35	4
He - W	21	78	106	33	109	54	84	82	33

KEY: 1. cold; 2. bright; 3. dark; 4. year; 5. spring; 6. summer; 7. fall; 8. winter.

The numerical values of Tables 4 and 5 are quite similar, the climatic behavior of Belgrade and Negotin also differ little in this respect. In general the class with normal temperatures and normal global radiation is amply represented. Bright days are relatively warm at noon, both summer and winter and dark days are relatively cool at noon. In the summer half of the year, however, even bright days rather frequently only show average noonday temperatures and in the winter half of the year dark days are also frequently moderately tempered. Thus, sunshine does not always mean high daily

temperatures, which is also of interest from the standpoint of tourism.

Table 5. Relative frequencies according to classes of the values of air temperature (t) at 1400 and the daily sums of global solar radiation (g) in °/₀₀, Negotin, 1966-1969 (VIII).

t / g	Kalt Hell	Normal Hell	Warm Hell	Kalt Normal	Normal Normal	Warm Normal	Kalt Dunkel	Normal Dunkel	Warm Dunkel
Nr.	1	2	3	4	5	6	7	8	9
J	6	15	10	12	23	6	4	21	3
F	1	10	8	5	26	10	5	33	2
M	6	14	12	7	24	11	15	10	1
A	4	16	18	8	20	13	13	8	.
M	2	34	13	4	31	6	7	3	.
J	.	28	28	10	15	3	9	6	1
J	5	46	14	7	21	2	3	2	.
A	2	27	28	5	15	15	4	4	.
S	5	17	23	2	27	14	9	3	.
O	2	13	20	2	15	27	8	13	.
N	8	3	2	7	8	7	28	35	2
D	2	7	1	9	19	5	15	38	4
4) Jahr	43	230	177	78	244	119	120	176	13
5) Fr	12	64	43	19	75	30	35	21	1
6) So	7	101	70	22	51	20	16	12	1
7) He	15	33	45	11	50	48	45	51	2
8) Wi	9	32	19	26	68	21	24	92	8
Fr – So	19	165	113	41	126	50	51	33	2
He – Wi	24	65	64	37	118	69	69	143	11

KEY: 1. cold; 2. bright; 3. dark; 4. year; 5. spring; 6. summer; 7. fall; 8. winter.

Wind Conditions.

The wind speeds shown in Tables 1-3 are not particulary high. On

an average the annual value is 2.6 m/s. There are storms in the region of the Iron Gate, however, and therefore we want to give additional data about the wind conditions.

Work [4] reported on the effect of the Transylvanian Alps on the structure of the east wind. The direction of extension of the isobars and the horizontal gradients of air pressure were shown there; these determine the structure of the flow of cold continental air which blows out of the Ukraine to the west. The investigated characteristic days had in common very small air pressure gradients above the Walachian plane and much larger gradients over the mountains of the Carpathians. Since the cold air mass is very shallow it cannot cross the high mountains and forms a sea of cold air over Walachia and from there the cold air for the most part flows through the river valleys of the Danube, the Timok, the Crna Reka, and others toward the west. Upon leaving these valleys the wind has increased speed and a gusty character.

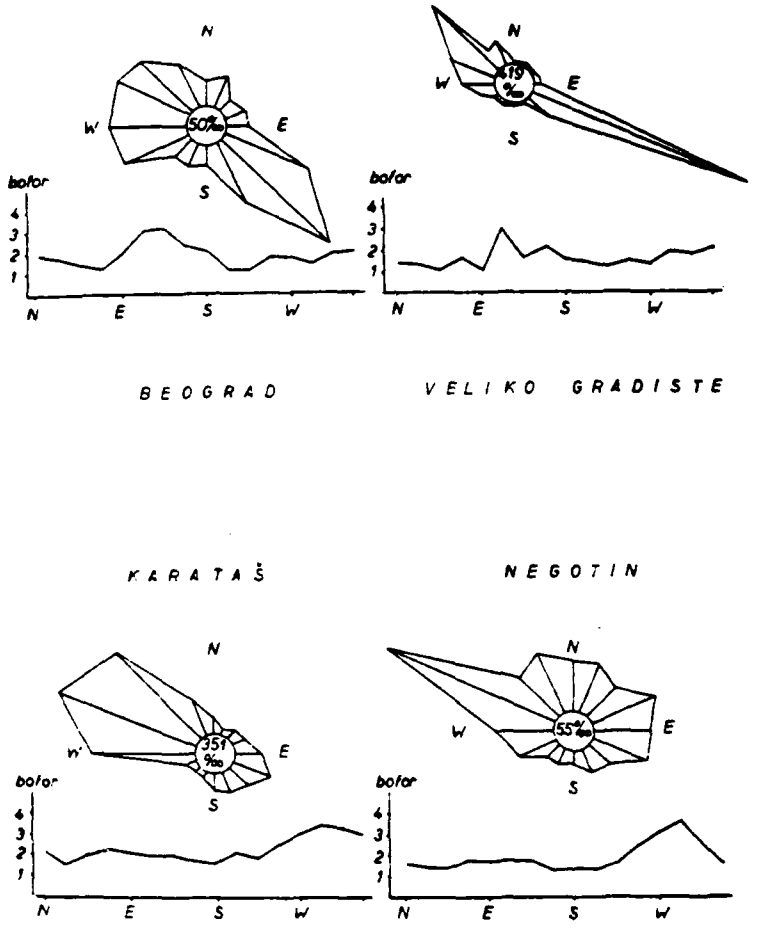


Fig. 2. Annual wind roses with the relative frequencies of wind directions and calms in °/₀₀ and the mean value of the wind strength for three locations in the area of the Danube, 1966-1969.

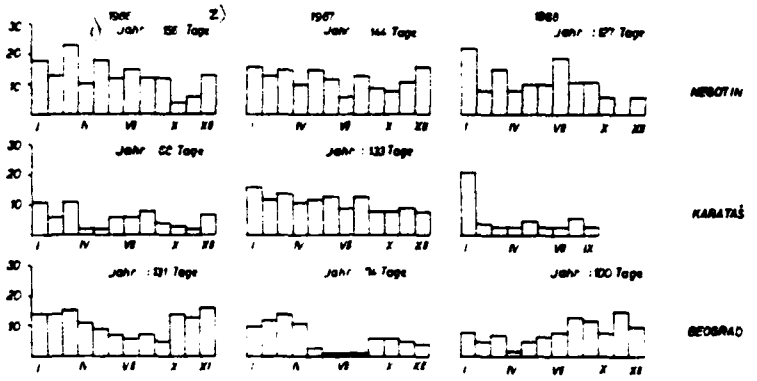


Fig. 3. Number of days with heavy- and storm wind in the Danube area in East Serbia in Yugoslavia in the years 1966-1968. KEY: 1. year; 2. days.

Fig. 2 shows the wind roses for 4 stations of the investigated region. The general distribution of wind directions shows a significant opposition between the areas west and east of the Iron Gate; to the west of Djerdap the winds are predominantly southeast winds and to the east of Djerdap, northwest winds. The gradient wind is apparently relieved and in the lower areas there are whirlwinds with winds from the opposite direction [cf. 7]. Fig. 2 shows the

average wind strengths of the individual directions in Beaufort degrees. It is apparent that the most frequent wind directions are also the strongest.

Fig. 3 also shows the number of days with strong winds and storm winds according to observations from the three years. Freshening up of the wind to at least Beaufort degree 6 is not a rare occurrence although the monthly and yearly averages of the wind velocity themselves are not high. There were days with strong winds in the years of the special investigations at the three stations depicted in Fig. 3 ranging from a low of 68 days to a high of 1556 days. A clear dependence of the strong wind days on the time of year cannot be recognized from the material. In an average over many years in Belgrade there are 118 days with occasional or day-long strong winds; in the year with the least wind there were 74 such days and in the year with the most wind, 158 such days.

In conclusion one can say that the conditions for tourism are most favorable from May to September. In October and November, as well as in March and April they are less favorable because of the occasional strong winds and the winter months of December through February are least favorable..

The large storage lake to a certain extent will moderate both

the winter and summer extreme conditions. Certain locations on the shores will be very favorable for viticulture. The main features of the climate of the area, however, will remain similar to the way they were depicted in this report.

LITERATURE

(1) Milosavljević, K. und M.: Uticaj orografije na raspodelu padavina u Istočnoj Srbiji. Zbornik radova Poljoprivrednog fakulteta, 1—11, (1962).
(2) Milosavljević K. und M.: Raspodela padavina u Istočnoj Srbiji pri vetrovima iz severozapadnog kvadranta. Zbornik meteoroskih i hidroloških radova br. 1. Savezni hidrometeorološki zavod, Beograd, 1—9, (1963).

3. K. Milosavljevic, M. Milosavljevic. Effect of the Transylvanian Alps on the climatic characteristics in East Serbia. III Conference for Carpathian Meteorology, Belgrade, 49-63 (1965).

4. M. Milosavljevic. Effect of the Transylvanian Alps on the structure of the easterly wind in the Pannonian plane. Reports from the German Weather Service No. 54, Frankfurt am Main, 236-240, (1959).

5. P. Janovic. Fundamentals of geomorphology. Belgrade, 1949.

6. G. Hentschel. Bioclimatic work- and valuation data for the practice of climate therapy, Akademie Verlag, Berlin, 5-10, (1969).

7. P. Vujevic. Meteorology, Belgrade, 332-333, (1948).

(8) Vujević P.: O geografskoj podeli i režimu kiša u našoj zemlji, Glasnik ministarstva poljoprivrede i voda, god. V, Br. 20, oktobar—decembar, 16, (1927).
(9) Čadež M.: Jezera hladnog vazduha. Hidrometeorološki glasnik 1, Beograd, 9—13, (1948).
(10) Conrad V.: Methoda in Climatology. Harvard University Press, 138, (1950).

11. E. Flach. Fundamental concepts and facts of bioclimatology. Left Meteorological Handbook, Vol. III, Leipzig, 222-225, (1957).

END

DATE
FILMED

3-82

DTIC